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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

December 28, 1983

IE BULLETIN NO. 83-08: ELECTRICAL CIRCUIT BREAKERS WITH AN UNDERVOLTAGE TRIP FEATURE IN USE IN SAFETY-RELATED APPLICATIONS OTHER THAN THE REACTOR TRIP SYSTEM

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP) for action.

Purpose:

The purpose of this bulletin is to assure proper operation of circuit breakers with undervoltage trip attachments (UVTAs) being used in safety-related applications other than as reactor trip breakers (RTBs). Toward this end, the bulletin describes recent findings involving such circuit breakers and asks holders of CPs and OLs to take certain actions. The subject breakers are similar to those identified in IE Bulletins (IEBs) 83-01 and 83-04. Holders of CPs and OLs are asked to: (1) identify the safety-related applications of the breakers and the systems in which they are used; (2) review the adequacy of the design, testing, and maintenance of the breakers in light of their operating experience and information conveyed in the bulletin; and (3) evaluate the need to take corrective measures to ensure proper operation of the breakers.

Description of Circumstances:

The reactor trip breaker failures experienced at Salem Unit 1 in February 1983, and RTB failures experienced in March at San Onofre Units 2 and 3 led to issuance of IEBs 83-01 and 83-04, respectively. An additional problem with RTBs having a UVTA was described in IE Information Notice 83-76.

Results of testing of RTBs required by IEBs 83-01 and 83-04 have been reported to the NRC. These results show that the reliability of certain RTBs may not be commensurate with their safety function. A review of reported breaker failures indicates that most failures can be attributed to the UVTAs and their associated linkages. Since the UVTA provides only a limited force to trip the breaker, problems of alignment and lubrication can result in a failure of the breaker to perform its intended function. Some examples of problems identified as causes for failure to trip of the circuit breakers include: (1) improper lubrication

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of linkages and other moving parts within either the UVTA or the circuit breaker trip bar latch assembly, (2) inadequate adjustment of spring tension of the UVTA, (3) excessive torque required to trip the circuit breaker because of hardening and contamination of the grease in the trip shaft bearings, and (4) excessive wear of moving parts within either the UVTA or the trip bar latch assembly because of infrequent lubrication of these moving parts or improper adjustments of the spring tension of the UVTA. The only types of RTBs being used in licensed PWRs are either Westinghouse (W) type DB, W type DS, or General Electric (GE) type AK-2 circuit breakers. Subsequent investigation into the matter also revealed that some PWRs and BWRs also employ similar breakers with similar undervoltage (UV) features in other safety-related applications. Examples of other systems that may be using the circuit breaker with UV features are the engineered safety features systems (for load shedding of the essential busses) and the 120 VAC uninterruptible power source from the motor-generator (MG) sets in BWR plants. Circuit breakers supplied by manufacturers other than W or GE may be used in some plants for these non-RTB applications.

In addition to the failures discussed above, a common mode failure of the GE type AK-2 circuit breaker occurred at Oyster Creek on November 30, 1978, during a loss of offsite power test. Both service water pump circuit breakers failed to trip, as required. The UV relays which monitor voltage level on each emergency bus functioned properly but did not actuate the breaker trip bar via the UV trip device within each circuit breaker. Ultimately the cause of failure was attributed to binding of the trip bar bearing in the breaker trip shaft assembly. The problem was corrected by cleaning and relubricating the trip shaft mechanism within the circuit breaker.

Although binding within the UV device and out-of-adjustment conditions in the linkage mechanism of the UV device were not a problem at Oyster Creek, GE had also determined that these conditions were a continuing problem at other nuclear power plants. (See IE Bulletin 79-09.)

The temporary overload condition on each emergency bus did not present a problem at Oyster Creek because those units are capable of full bus load pickup. However, as stated above, the load shedding feature of the emergency busses during the above test conditions did not function as designed.

Another failure, similar in nature to the early failure at Oyster Creek, occurred again at that plant in March 1983. In this event the circuit breaker involved provides power to one of two control rod drive mechanism pumps. As in the case of the 1978 event, this problem was also corrected by cleaning and relubricating the trip shaft mechanism within the circuit breaker.

In addition to the above mentioned breaker failures, each being a failure to trip on demand, we are also concerned about breakers with UVTAs failing to close on demand.

Failures of breakers to close are described in Information Notice 83-50. After issuing that notice, the NRC became aware of a failure to close that occurred during life cycle demonstration tests conducted by W that was directly

related to the UVTA latching mechanism. This failure occurred on a new UVTA that was initially lubricated in accordance with the latest W recommendations but which, for test purposes, was not subsequently lubricated. (Note: W recommends relubricating the UVTA and its linkages after 200 operations.) This failure to close occurred after 571 trip and reclose operations, and was attributed by W to normal latch wear. As a result of the latch wear, the breaker mechanism was placed in a "trip free" condition such that the breaker could not be closed electrically or manually. This failure does not represent a safety concern in an RTB application (i.e., such failures block the withdrawing of control rods, thereby assuring that the reactor remains sub-critical). However, there is a concern that such failures could, in other applications, prevent the performance of a safety-related function.

Generic Letter 83-28 was issued to all holders of an OL or CP on July 8, 1983. Sections 2.2 and 3.2 of that letter require implementation of a program that ensures that all components of safety-related systems are correctly identified and classified, and that the appropriate procedures (including vendor recommendations) are used for maintenance, surveillance, parts replacement, qualification testing, and post-maintenance operability testing. That letter, of course, applies to circuit breakers in safety-related systems that use a UV trip feature. Any information requested by the action items of this bulletin that has been previously provided to the NRC in response to Generic Letter 83-28 may be referenced.

Actions To Be Taken by Holders of Construction Permits and Licensees for Operating Reactor Plants

1. Identify applications of W type DB, W type DS, or GE type AK-2 circuit breakers with the UV trip feature as discussed in IEB 83-01 or 83-04 in safety-related applications at your facility(ies), other than as RTBs. CP holders and licensees should also identify similar applications of other types of breakers by other manufacturers that use a UV trip feature. If such circuit breakers are used or planned for use, identify the system(s) involved.
2. For each circuit breaker type identified in Item 1, do the following:
 - a. Review the design of the UVTA and the connecting linkage. Using input from the breaker manufacturer, determine the design margin available to open the breaker. Evaluate whether or not this design margin is adequate in view of safety applications, considering possible problems of alignment, lubrication, adjustment of spring tension, etc., discussed in the "Description of Circumstances."
 - b. Describe the current breaker surveillance program, including details of test frequency, methodology, and response time measurement of UVTA device.
 - c. Review operating experience with the circuit breakers in your plant(s) identified in Item 1. Provide a list of all malfunctions (both failure to trip and failure to close on demand) associated with

the UVTA, including the connecting linkages and latching mechanisms. The list should include the date of each malfunction, and the operating time prior to failure or date of installation, and the date(s) of major maintenance. In general, when the circuit breaker UVTA is actuated on undervoltage and the breaker contacts do not open within the design time response value, the NRC considers the breaker to have failed.

- d. Describe any preventive or corrective measures you have taken, or intend to take, based on the results of Items 2a, 2b, and 2c. Include any revisions to the surveillance test program and methodology. Specifically, address the inherent reliability of the UV trip feature in view of its apparent heavy dependence on intensive maintenance and surveillance and whether a basic design change is warranted to correct the problem, e.g., using a voltage sensitive relay to sense loss of voltage and energize the shunt trip coil from an independent dc power source.
3. For facilities with an OL, submit a written report addressing the above action items, including the schedule for completion, within 90 days of receipt of this bulletin.
 4. For facilities holding a CP, submit a written report addressing the above action items, including the schedule for completion, within 90 days of receipt of this bulletin, or before receipt of an operating license, whichever is sooner.

If the above schedules result in an undue hardship, a licensee or CP holder may request an extension from the appropriate Regional Administrator.

The written report required shall be submitted to the appropriate Regional Administrator under oath or affirmation under provisions of Section 182a, Atomic Energy Act of 1954, as amended. Also, the original copy of the cover letters and a copy of the reports shall be transmitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555 for reproduction and distribution.

Licensees not using circuit breakers with a UVTA in safety-related applications (other than the reactor trip system) shall submit a negative declaration within 90 days of the receipt of this bulletin.

This request for information was approved by the Office of Management and Budget under a blanket clearance number 3150-00011 which expires April 30, 1985. Comments on burden and duplication may be directed to the Office of Management and Budget, Reports Management, Room 3208, New Executive Office Building, Washington, D.C. 20503.

Although no specific request or requirement is intended, the following information would help the NRC evaluate the cost of this bulletin:

1. Staff time to perform requested review.
2. Staff time spent to prepare requested documentation.

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office or the technical contact listed below.



Richard C. DeYoung, Director
Office of Inspection and Enforcement

Technical Contact: V. D. Thomas, IE
301-492-4755

Attachment:
List of Recently Issued IE Bulletins

LIST OF RECENTLY ISSUED IE BULLETINS

| Bulletin No. | Subject | Date of Issue | Issued to |
|-----------------|--|---------------|--|
| 83-07 Supp 2 | Apparently Fraudulent Products Sold by Ray Miller, Inc. | 12/09/83 | Same as IEB 83-07 |
| 83-07 Supp 1 | Apparently Fraudulent Products Sold by Ray Miller, Inc. | 10/26/83 | Same as IEB 83-07 |
| 83-07 | Apparently Fraudulent Products Sold by Ray Miller, Inc. | 07/22/83 | All power reactor facilities holding an OL or CP; Other fuel cycle facilities and Category B, Priority I (processors and distributors) material licensees. |
| 83-06 | Nonconforming Materials Supplied by Tube-Line Corporation Facilities at Long Island City; New York; Houston, Texas; and Carol Stream, Illinois | 07/22/83 | All power reactor facilities holding an OL or CP |
| 83-05 | ASME Nuclear Code Pumps and Spare Parts Manufactured by The Hayward Tyler Pump Company | 05/13/83 | Utilities with power reactor facilities holding an OL or CP use or plan to use ASME Nuclear Code Pumps Mfg by Hayward Tyler Pump Co. |
| 83-04 | Failure of the Undervoltage Trip Function of Reactor Trip Breakers | 03/11/83 | All PWR facilities holding an OL except W DB type breakers for action and other nuclear reactor facilities for information |
| 83-03 | Check Valve Failures in Raw Water Cooling Systems of Diesel Generators | 03/11/83 | All power reactor facilities holding an OL or CP |
| 83-02 | Stress Corrosion Cracking in Large-Diameter Stainless Steel Recirculation System Piping at BWR Plants | 03/04/83 | Table 1 BWRs for action and all other licensees and holders of a CP |

OL = Operating License
CP = Construction Permit